REMARKS/ARGUMENTS

Claims 1-31 are pending in this Application, and have been made subject to a multiple Restriction Requirement. 5 groups have been designated:

I. Claims 1-18, drawn to a nickel-based braze composition;
II. Claims 19-24, drawn to a method for joining;
III. Claims 25-29, drawn to a method for filling a cavity in a component;
IV. Claim 30, drawn to a superalloy component jointed to another metal component; and
V. Claim 31, drawn to a superalloy article having a cavity filled with a nickel braze composition.

It is the Examiner's position that each of the inventions listed in the five groups is distinct from each other, and the reasons for the distinctions are provided on pages 2-5 of the Office Action. In brief, Inventions I and II are said to be related as product and process of use, and the same is indicated for Inventions I and III. Furthermore, the Examiner submits that Inventions I and IV are related as mutually-exclusive species in an intermediate-final product relationship. Moreover, the Examiner maintains that Inventions II and III are directed to related processes which are mutually exclusive and legally distinct; while Inventions IV and V are characterized in the same manner. Inventions II and IV are related as a process of making and a product made, as are Inventions III and V.

Applicant had made a provisional rejection , with traverse, to prosecute the invention of Group I, claims 1-18. The present communication affirms that election, and Applicant also acknowledges the duty to amend inventorship if the election would change the original designation thereof.

While Applicant appreciates the detailed explanation regarding reasons for Restriction, there continues to be respectful disagreement about the decision. The method inventions of Groups II and III are clearly part of a single inventive concept which can be searched and examined in unitary fashion, without

undue burden to the Patent Office. Moreover, the methods recited in the claims of those groups are closely related to the composition of claim 1. As an example, both the joining technique of claim 19, and the cavity-filling step of claim 25, depend to a great degree on the same type of nickel/-palladium-based alloys recited in claim 1. Moreover, the Examiner's specific example about distinctness between Groups I and II is not entirely understood (see bottom of page 2 of the Office Action). In exemplifying the Restriction-parameter that "the product...can be used in a materially different process...", the Examiner states that the claimed product can be used "to fill a cavity". Applicant submits that this is not a "materially different process" which would separate Group I from Group II. Claim 1 is not restricted to any particular method, and as stated above, both process concepts of Groups II ("joining") and III("filling") depend on the same product of Group I.

Applicant also objects to the separation of claims 30 and 31 into two separate inventions. Both claims relate to superalloy components, even though the context is different, i.e., a joined component in claim 30, and a component having a filled cavity in claim 31. The components themselves do not have materially different designs, and are clearly related to one another by way of the braze composition recited in claim 1. Furthermore, there would be no additional burden in searching the subject matter of claims 30 and 31 as a single concept.

Applicant also has difficulty with some of the other theories for the Restriction Requirement. For example, the "intermediate-final product relationship" which is relied on to divide Inventions I and IV, as well as Inventions I and V, does not seem to be tenable. The braze composition of claim 1, and its use in various articles like those of claims 30 and 31, does not appear to satisfy the "intermediate-final" relationship. Each article still includes the presence of the braze material, and nothing has been "transformed" from an intermediate stage to a final stage.

The undersigned reviewed these issues briefly with Patent Office Examiners on at least one occasion. While there may be some justification for the separation of the pending claims into two or even three groups, five groups is clearly extreme, and places a serious burden on Applicant, in terms of both time

and expense. Therefore, the undersigned again requests withdrawal of the Requirement, or modification of the same to a more manageable situation.

Claim Rejections – 35 U.S.C. 102

Claims 1-4, 8 and 15 have been rejected under 35 U.S.C. 102(b), as being anticipated by a patent issued to E. Huschke, Jr., et al, US. 3,089,769. ("Huschke"). It appears to be the Examiner's position that Huschke teaches alloy compositions which meet the limitations of Applicant's claims. Applicant believes that the claims are not anticipated by the Huschke reference.

An appropriate beginning to this discussion might involve a brief review of the present invention. Some of the chief embodiments relate to a nickel-based braze composition which contains relatively high levels of palladium. The present inventors discovered that the palladium could function to promote the formation of a nickel-based amorphous phase, and lower the melting temperature, thereby reducing the braze temperature to a desired level. Unlike metalloid elements (e.g., boron and silicon), which are also used as melting point suppressants, the use of palladium does not result in the significant formation of secondary phases which would produce undesirable properties. Thus, the present invention, while including silicon and/or boron, maintains each of these constituents at very restricted, minimal levels. Claims 3-4, for example, recite specific boron/silicon levels for some embodiments.

In other embodiments, the brazing composition includes the elements tantalum, titanium, or zirconium. As described in the specification, e.g., paragraph 30, the presence and amount of these elements is often influenced by the nature of the workpiece(s) being brazed. Thus, some of the compositions used in brazing commercial superalloys may contain selected amounts of titanium, while others may contain selected amounts of tantalum. Clams 5-7, as well as claim 16 (as amended), recite the presence of these elements.

In certain other embodiments, the brazing compositions contain selected amounts of aluminum or chromium, or a combination of these two elements. As described in paragraph 32, these elements provide notable advantages. For example, they can enhance the oxidation resistance of the braze at high temperatures. Moreover, aluminum is often used to provide strength to the braze compositions. (The integrity of the braze composition at high temperatures, or during temperature cycling, is critical to the integrity of the article(s) being brazed). When present, however, the maximum amount of chromium and aluminum is restricted, due in part to the precise balancing of performance characteristics for the braze composition. The presence of aluminum and chromium is documented in original claims 8-10, 15-16, and 18.

The brazing composition may also include one or more other elements which are important in certain applications. Claims 11 and 12 recite the presence of cobalt, while claims 13-14 recite the presence of carbon, molybdenum, tungsten, rhenium, and iron. Moreover, as recited in claim 16, the amounts of some of the elements mentioned above are restricted to levels which maintain a maximum "liquidus temperature". As described in paragraphs 36-39 of the specification, the liquidus temperature of the braze is very important when adjusting the composition of the braze to accommodate the presence of some of the heavily-alloyed components, e.g., the refractory elements. (See the discussion in paragraphs 8 and 9 as well, regarding flow characteristics for the braze).

Huschke is directed to nickel-chromium-palladium alloys which are used for brazing. As described in column 1, lines 47-52, the alloys contain 15-40 wt % Cr, 5-35 wt % palladium, with the balance consisting essentially of Ni. A variety of other elements can also be included. The following are described (using conventional chemical element symbols): Si, Ta, Cb(Nb), Fe, B, Sb, Mn, In, and Au. The patent also includes a ternary diagram which describes various liquidus isotherms which exist in the alloy system. Moreover, the presence of a number of elements being optionally used as melting point suppressants is described, from column 3, line 55 to column 4, line 4. Table III of Huschke sets out various exemplary alloy compositions covered by the reference.

Certainly, Huschke recites a composition which is in some ways similar to the compositions of the present invention. However, a rejection under 35 U.S.C. 102(b) of the statute requires that the reference contain or "meet" every limitation of the claims in the patent application. Huschke fails to do so - especially in the case of Applicant's amended claims. The reference is directed to alloys which have relatively high levels of chromium, and relatively low levels of palladium (e.g., see col. 1, lines 40-41 and 47-52). In marked contrast, many specific embodiments of the present invention are based on relatively high levels of palladium, for the reasons mentioned above and described in the specification.

Moreover, when chromium is present in the braze composition of this invention, its level is generally below that required for Huschke. As described in the specification (e.g., paragraph 32), the total amount of aluminum and chromium is usually in the range of about 0.5 to 30 atom %. In paragraph 35, the preferred level of chromium for some embodiments is about 7 to 15 atom %. In contrast, the compositions referenced by the Examiner in Huschke (Table III, #'s 66 and 75) have much higher chromium levels – 38.5 atom % and 34.2 atom %, respectively, converted from weight percent.

Although Applicant continues to maintain that original claim 1 is patentable over Huschke, the claim has been amended to reduce issues in prosecution. Support for the claim is found in the other, original claims, and in the specification, e.g., paragraph 32 and paragraph 35 (16 atom % for Al, 15 atom % for Cr), as well as Table 2. Related changes have also been made to other claims, for the sake of consistency.

Moreover, the presence of at least one of boron or silicon is clearly optional in Huschke (col. 3, line 67 to col. 4, line 1). In contrast, the presence of at least one of these elements is a key limitation of the present invention. (See claims 1 and 3-4).

While some of the teachings of Huschke are not as relevant under the Section 102 rejection, Applicant notes that there are other significant differences between the present invention and the cited patent. For example, while describing

the possible use of tantalum in the brazing compositions, Huschke appears to be silent about the presence of titanium or zirconium. (Note Huschke's description of the braze material, which is distinct from the description of the alloys actually being brazed). The same appears to be true for cobalt, which is featured in some of Applicant's claims. Moreover, the reference never discloses or suggests brazing alloys based on constituent elements which provide the liquidus limitation of claim 16.

Claim Rejections – 35 U.S.C. 103

Claims 1-3 and 5-18 have been rejected under 35 U.S.C. 103(a), as being unpatentable over USSR Patent 529,924, issued to Lashko et al ("Lashko"). As translated, Lashko describes what appears to be a brazing composition or "spelter". On page 3 of the translation, the composition is described as containing, in weight percent: up to 24% nickel and/or cobalt; up to 40% chromium; up to 5% iron; smaller amounts of various other elements (including boron and silicon); with the balance being palladium. Other sample alloys are also provided in Lashko. For example, the composition on page 4 specifies 20%-55% by weight palladium; 3.6%-7.6% chromium, along with various other elements, and a balance of nickel. This appears to be substantially the same composition on page 7 (discussed by the Examiner), which is the claim of the patent. As noted on page 4 of the reference, the composition appears to be contemplated as the solution to the problem of excessively high brazing temperatures.

As in the case of Huschke, Lashko has constituents which are similar to the present invention. However, Lashko is even further removed from Applicant's claims. The patent clearly contemplates alloys with very high levels of chromium, in contrast the present claims. Moreover, the level of palladium appears to be potentially very high. As an example, the alloy on page 3 of Lashko has a limitation of nickel at 24 wt %, and the dominant ("balance") element is clearly palladium. Furthermore, the page 4 composition allows up to 55 wt% palladium. Applicant's claimed invention is nickel-based – not palladium-based.

The Examiner notes that there is overlap between the claimed invention and the alloy composition on page 7 of Lashko. Applicant does not dispute that conclusion. However, the overlap of some of the constituents does not establish a prima facie case of obviousness in this instance. In allowing such large amounts of palladium, Lashko clearly does not contemplate alloys suitable for the high-strength, high-temperature environment in which nickel and cobalt superalloys operate (See Applicant's Background, in paragraphs 2-4 and 13-14; as well as paragraph 8, regarding the necessary combination of braze flow and selected physical properties). Moreover, the reference never suggests the possibility of allowing substantial amounts of tantalum, titanium, and zirconium, as in pending claims 5-7 and 16. The substantial presence of such alloys is sometimes very important when brazing high-temperature structural articles, as mentioned previously.

The Examiner also argues that the pending claims are obvious because Lashko teaches the "same utility" throughout the disclosed ranges. Applicant acknowledges that the reference appears to be addressing the problem of high brazing temperatures (page 4, top paragraph). The resulting invention appears to be directed to brazing compositions with lower melting points and better diffusion characteristics (page 5, first full paragraph). However, absent melting point suppression, the utilities are not the same. As noted above, Lashko has nothing to do with brazing compositions suitable for high-strength, high-temperature superalloys. Lashko also fails to suggest the problem of having significant amounts of metalloids (boron and silicon) in the braze compositions, or the benefit and utility of restricting the levels of such elements. Moreover, the reference, in widely describing various elemental components without any recognition of Applicant's inventive objectives, fails to ever suggest the particular alloy compositions recited in claims 17 and 18.

In regard to claim 16, the Examiner argues that the compositions of Lashko would inherently have the same liquidus temperature as stated in the claim, since the composition is "substantially the same". Applicant respectfully disagrees with this supposition. The composition on page 7 of the patent covers substantial ranges for many constituents. In contrast, claim 16 is directed to specified

amounts or ranges of one or more elements (Ta, Ti, Zr, Al, Cr) which will specifically provide the braze liquidus-maximum of about 1230°C. Nothing in Lashko describes or hints at the suggestion of a range of elements which will provide such a specific characteristic.

Conclusion

Applicant submits that the pending claims – those which are original and those which are amended - are patentable over the cited references. It is thus requested that the case be placed in allowance. The undersigned would be interested in discussing any remaining issues with the Examiner, if an interview might resolve those issues.

Respectfully submitted,

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